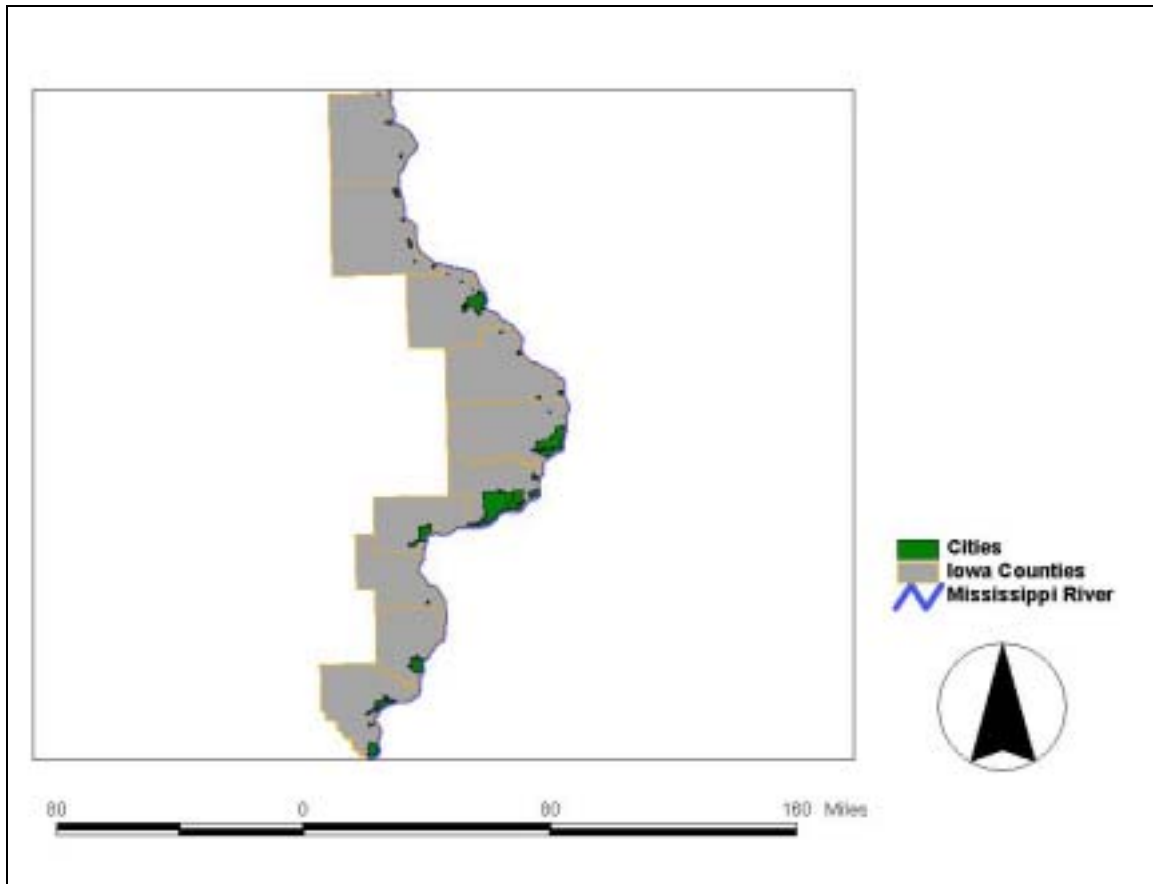


## APPENDIX A. GIS ANALYSIS FOR THE MRT

The Iowa Mississippi River Trail plan was created through a data-driven analysis using geographic information systems. GIS integrates map images with relevant data, resulting in a powerful tool for ranking corridors for bicycle lanes for the MRT.

### Gathering Data for MRT Maps

The first step in creating maps for the recommended Mississippi River Trail involved gathering background data needed to analyze potential trail conditions. First, a project area was created using the 10 Iowa counties on the Mississippi River, their cities, and the river itself. Figure A.1, the project area map, served as the base map for all of the plan's study maps. Because these maps are very detailed, this appendix will use individual counties hereafter as examples; maps for each county for each data effort are available in Appendix B.



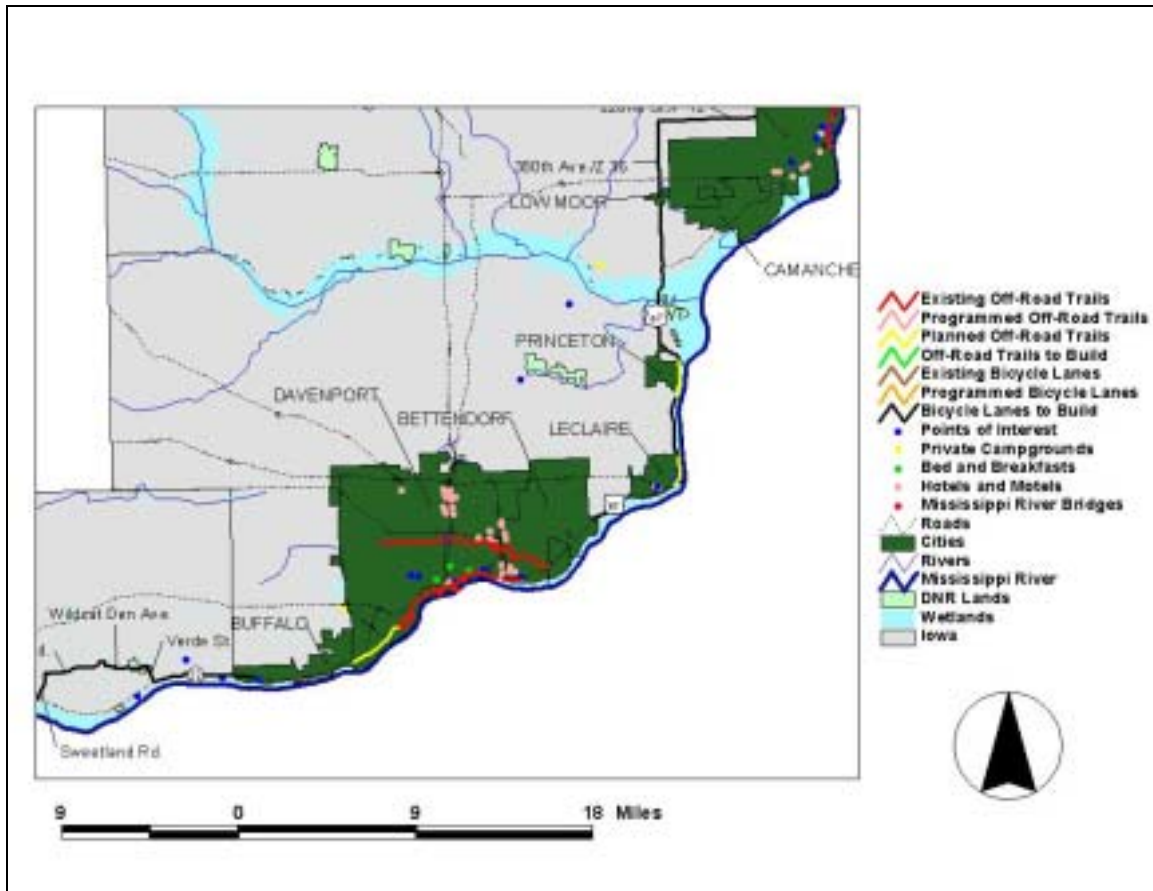
**Figure A.1. MRT Project Area**

## Trail Amenities

Once the base map was established, certain types of data were collected to determine trail feasibility. First, potential trail amenities were gathered. Perceived amenities for the MRT were varied, tailored to the unique benefits offered by each county, and mapped in GIS. An innate benefit of the Iowa MRT that could not be measured by GIS is the short distance between cities, which creates natural trips for cyclists. The perceived amenities that could be measured by GIS were added to the amenities maps:

- Rivers, wetlands, and Iowa Department of Natural Resources land in the 10 counties were added because these features are assets to the future users of the MRT for recreational and educational purposes.
- Levees were added because they showed possible future use for off-road trails.
- Existing and proposed bicycle trails and lanes (on-road facilities) in the 10 counties were added because these facilities could be delineated as the MRT or as side routes.
- Potential MRT connections to Minnesota and Missouri were added to guide Iowa trail planning.
- Potential pedestrian bridge or water taxi/ferry connections were added to create connections to Wisconsin and Illinois trails.
- Points of interest along the river in the 10 counties were added because of their value to potential MRT users.
- Hotels, motels, and bed and breakfasts along the river were added to accommodate out-of-area trail users.

Figure A.2 illustrates the effects of trail amenities in Scott County to the MRT. There is an extensive existing trail network in the Quad-Cities area, notably through Davenport and Bettendorf. However, this trail network is proposed for extension, connecting Buffalo and Davenport through either a trail or bicycle lane, connecting the Davenport and Bettendorf trails, adding trails in Le Claire through a realignment of U.S. Highway 67 through the city, and adding trails in Princeton through a city greenway plan. In addition to bicycle facilities, this area, especially Davenport and Bettendorf, contains many points of interest, hotels, motels, and bed and breakfasts to accommodate cyclists. Also, the Quad-Cities area contains two notable methods of crossing the Mississippi River, which cyclists may use to access Illinois trails. Two bridges in Davenport are pedestrian and bicycle friendly, and another cyclist option for crossing the river is the Channel Cat, the Quad-Cities' ferry.



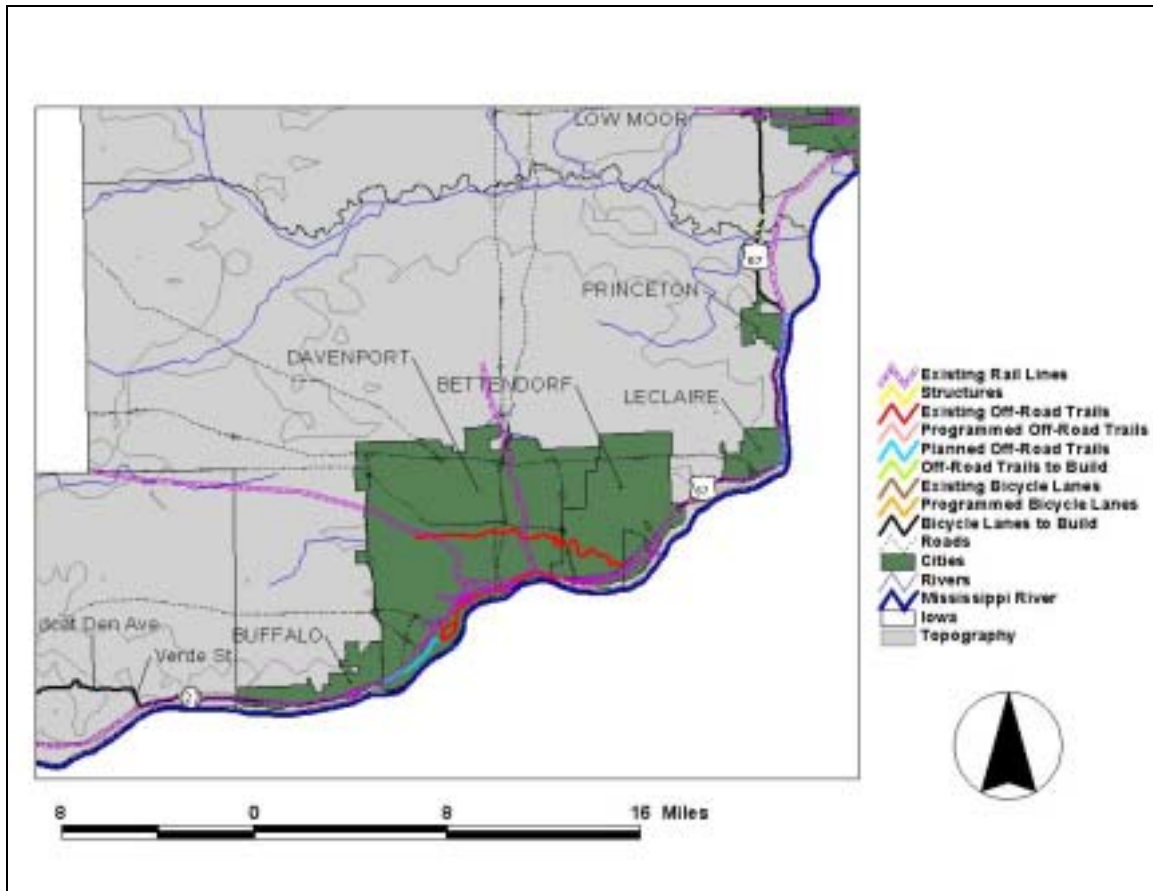
**Figure A.2. Scott County Trail Amenities**

### Trail Development Concerns

Another aspect of trail feasibility includes examining potential concerns of trail construction, such as the following.

- Topography could cause problems for cyclists due to steep grades in the northern section of the project area.
- Structures on proposed routes create additional costs for trail construction.
- Railroad crossings can be hazardous if not designed to accommodate cyclists.

The data needed to analyze potential concerns were used to create a map to visually compare areas of concern to trail development. Figure A.3 illustrates the effects of trail development concerns using Scott County as an example.



**Figure A.3. Trail Development Concerns: Scott County Example**

The overall topography of Scott County does not present a hindrance to the MRT. Scott County is generally flat, with small changes in elevation; the flatness of the area will make the MRT accessible for all levels of cyclists.

Some potential MRT routes do have structures on the roadway, which could substantially raise the costs of trail development. However, U.S. Highway 67 contains fewer structures than the alternative route, so U.S. 67's structures could be less expensive to accommodate the MRT than the alternative route's structures.

The placement of rail lines may also present problems to MRT cyclists, for crossing railroad tracks on a bicycle can be hazardous unless the crossing is adapted to accommodate bicycles. Scott County's rail lines tend to run parallel to roadways, notably U.S. 67, so the adaptation of railroad crossings to accommodate bicycles will not be an important issue.

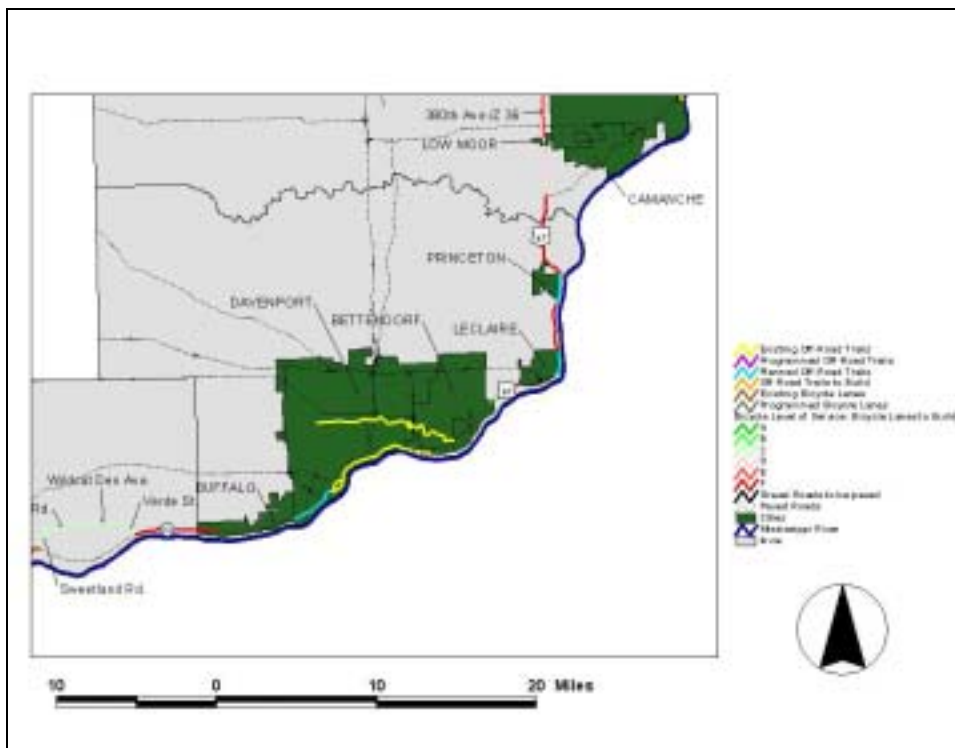
### **Bicycle Level of Service**

The planning of the MRT focuses on the creation of bicycle lanes. Because these are on-road facilities, traffic on potential routes needs to be considered to ensure a safe

environment for the future cyclists of the MRT. The BLOS measure can be used to estimate the safety and comfort of the cyclist (League of Illinois Bicyclists and Chicagoland Bicyclist Association 2002). The BLOS scale ranges from A (extremely high) to F (extremely low). Trail planners and advisors for the Iowa MRT believe that the lowest acceptable BLOS for the Iowa MRT is a level of C. The League of Illinois Bicyclists and the Chicagoland Bicyclist Association derived the BLOS used for MRT planning.

Because BLOS measures the comfort of the bicycle lane cyclist, traffic and roadway data are used in its calculation. The BLOS calculation assumes the lane is on a paved road; therefore, nonpaved roads were removed from the study. Aside from road material types, other influential data for the BLOS calculation include number of lanes, lane width, paved shoulder width (where the bicycle lane would be placed), annual average daily traffic counts, percentage of heavy vehicles, and speed limit. BLOS was calculated within ArcView and then mapped so that visual analysis of feasible routes was possible.

An example of the map output of this process can be seen in Figure A.4. Scott County's major asset to the MRT is Highway 67 along the Mississippi River. However, this corridor currently ranks an E on the BLOS scale, due mainly to small shoulders and heavy traffic counts. An alternative route away from the river, routed on county roads, fares better with rankings of C and D. The MRT is to be placed on corridors with a BLOS score of C or better, and neither corridor offers such a solution; another alternative corridor or possible road improvements must be provided for the MRT in Scott County.



**Figure A.4. BLOS Study: Scott County Example**

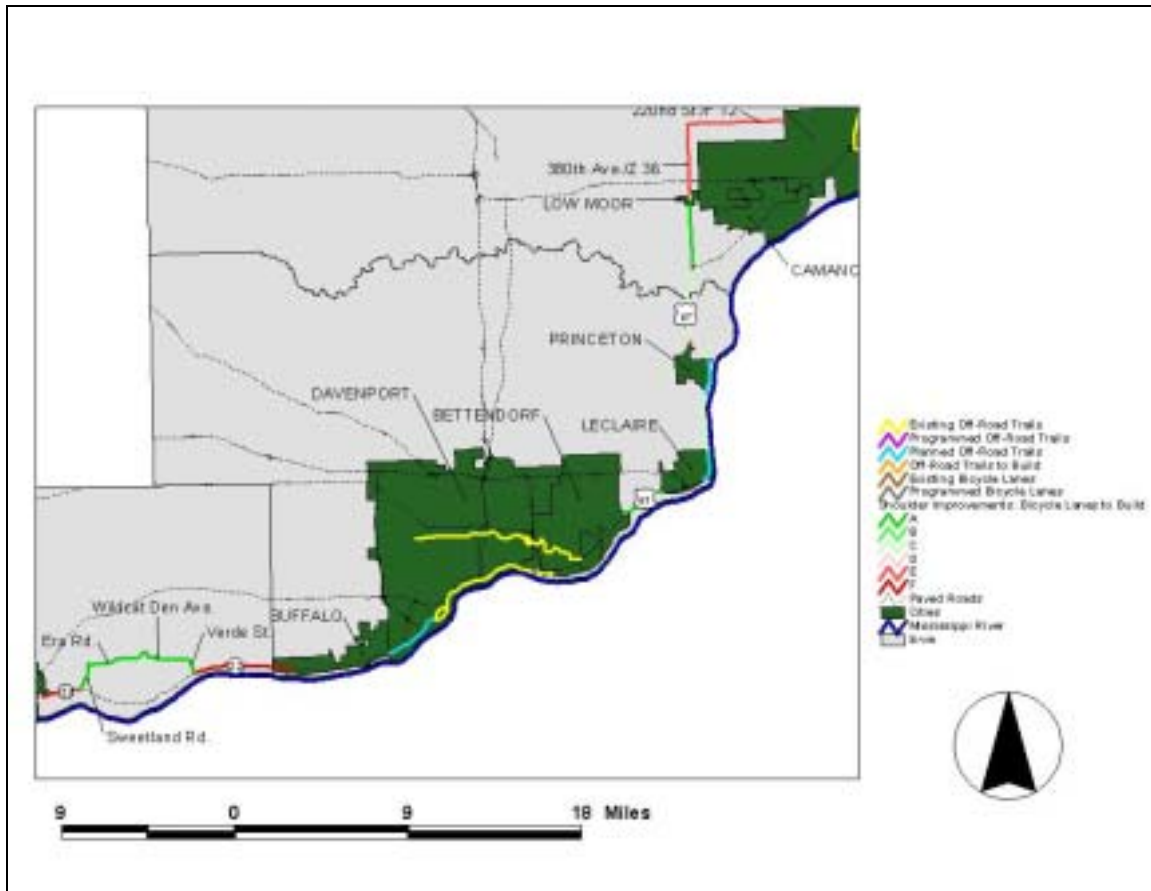
## Viability of Roads After Shoulder Improvements

While the BLOS calculation could find roadways suitable to currently accommodate a bicycle lane, it could not analyze how a road's BLOS score could improve with road improvements. For instance, if a road corridor with no shoulders yielded a BLOS score of D, the score could possibly change if paved shoulders were added to the corridor. The on-road sections of the MRT will be bicycle lanes, which require paved shoulders. Because any road being considered for inclusion in the MRT needs to have paved shoulders, adding certain widths of paved shoulders to the roads under consideration may improve the route's BLOS when it is ready to accommodate a bicycle lane.

To measure the effects of adding paved shoulders to these routes, a certain width of paved shoulder was hypothetically added to each corridor, depending upon its current width of paved shoulder. The *AASHTO Guide for the Development of Bicycle Facilities* (1999) states that a paved shoulder width of 1.2 meters (4 feet) is recommended for bicycle travel, but this width should be increased if the roadway carries high-speed travel of 80 kilometers/hour (50 miles per hour) or greater. Much of the Iowa MRT will be located on high-speed facilities; for the safety and comfort of the cyclist, the MRT bicycle lanes should be at least 6 feet in width. In the BLOS study, all corridors received at least 6 feet of hypothetical paved shoulder. The results of the study were positive; corridors with currently less than 6 feet of paved shoulder did experience an increased BLOS score after the shoulder improvements study.

The resulting BLOS scores were then classified into three groups of roads: "currently adequate for bicycle facilities," "shoulder improvements needed," and "not adequate for bicycle facilities." Each classification rated each corridor on its sufficiency to carry a bicycle lane. The rating "Currently Adequate for Bicycle Facilities" denotes corridors that could carry a bicycle lane without the construction of additional shoulder width. Conversely, "Shoulder Improvements Needed" indicates corridors where bicycle lanes could exist with the construction of additional shoulder width. Finally, "Not Adequate for Bicycle Facilities" designates corridors that would not be suitable for bicycle lanes, even with the construction of additional shoulder width.

Figure A.5 illustrates the changes in bicycle lane suitability with the construction of additional shoulder width. After additional shoulder width is included in Scott County, most of U.S. Highway 67 and the alternative county roads can now safely add a bicycle lane. However, there are small sections of U.S. 67 that will not be suitable for a bicycle lane, even with shoulder improvements. If U.S. 67 is chosen as a route, alternatives must be made for the sections of unsuitable roadway. Possible solutions to unsuitable expanses of roadway could include off-road trails or other alternatives.



**Figure A.5. Shoulder Improvement Study for Scott County**

### **Comparing All Levels of Trail Plan with Actual Conditions to Develop the MRT**

The individual studies of trail amenities, concerns, BLOS, and shoulder improvements are key links to the creation of the MRT, but these studies needed to be consolidated to fully understand the best placement of the trail. For example, by looking at Figures A.2–A.5, prime locations for the MRT can be seen. For example, in Figure A.2, good locations with regard to trail amenities would be near points of interest, lodging, and river crossings. Figure A.3 shows areas of concern for building bicycle facilities, such as on-road structures; the corridors with the least points of concern were best for construction. Figure A.4 shows that most of U.S. Highway 67 and portions of the alternative route of county roads in Scott County were unsuitable for bicycle lanes. Figure A.5 shows that after shoulder improvements are made, the majority of these roads could safely carry a bicycle lane.

However, while the GIS analysis has produced a trail that appears to be feasible on paper, the designated route may have characteristics that cannot be studied by GIS. To determine if the route designated by GIS is feasible, input from local officials was considered, along with field reviews of the proposed MRT route. During the planning process, three public input meetings were held to facilitate review of the Iowa MRT by

local officials and citizens. Details of these meetings, held in Lansing, Davenport, and Fort Madison, Iowa, are outlined in Appendix C.

After comparing different levels of trail-related information, most non-GIS analysis concurred with the routes chosen through the data-driven GIS methods, with two notable exceptions:

1. State Highway 22, east of Muscatine, was found to be unsuitable for bicycle lanes in the GIS analysis. However, the data used in the GIS analysis were a few years old, which caused a discrepancy between the data corridor conditions and actual corridor conditions. U.S. Highway 61, which runs parallel to Highway 22, was expanded to a four-lane divided corridor and opened after the data for the GIS analysis were collected. Therefore, the Highway 22 traffic conditions in the analysis reflected the time period before the U.S. 61 improvements were finished. Although official traffic counts have not been taken on Highway 22 after the U.S. 61 improvements, Muscatine County officials have reported lower traffic counts and, notably, lower heavy truck traffic counts. Field reviews concurred with this observation. Because of this and recommendations from local officials, portions of Highway 22 east of Muscatine are recommended for the MRT.
2. State Highway 99 throughout Des Moines County was found to be unsuitable for bicycle lanes in the GIS analysis. However, field reviews and local recommendations agree that Highway 99 would be safe for bicycle lanes; local cyclists currently ride the highway and believe it could safely carry bicycle lanes.